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FEDERAL COMMUNICATIONS COMMISSION
OFFICE OF THE SECRETARY

October 18, 1993

Via Airborne Express

Regina Harrison, Esq.
Federal Communications Commission
Mass Media Bureau
2025 M Street, N.W., Room 8002
Washington, DC 20554

Dear Ms. Harrison:

Enclosed are materials we discussed today:

1. Listed in footnote 5 of Capital Cities/ABC's Comments filed on May 7, 1993 in MM Docket 93-48.

a. The article entitled "Properties of Attention During Reading Lessons."

b. A "Technical Memo" written by John Wright. This memo summarizes his unpublished study conducted at the Center for Research on the Influence of Television on Children. As the footnote indicates, Mr. Wright's study was reported in Conference Proceedings: Television and the Preparation of the Mind for Learning. I have enclosed the portion of the transcript (pp. 90-91) referring to that study. You will note that on those pages Dr. Daniel Anderson refers to his own study. In order to give you more context, I have included the pages of the transcript which describe Dr. Anderson's study.

2. The Sandra Calvert study listed in footnote 6 of ABC's Comments.

Please let me know if I can be of any further help.

Sincerely,

Kristin C. Gerlach

Kristin C. Gerlach

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Properties of Attention During Reading Lessons

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This study investigated the attention of 116 children in 6 2nd- and 3rd-grade classrooms while they participated in 4 lessons involving progressively more difficult stories. Analysis of videotapes of the lessons revealed that the likelihood of a lapse of attention was highest during the first 15 s of attention episodes. Lapses in attention were more likely among 2nd graders than among 3rd graders, among boys than among girls, in low groups than in middle groups, and in middle groups than in high groups. The more difficult the story, the more likely were lapses in attention, especially among younger and less able students. Reading-group membership was more strongly related to attention than were reliable measures of children's individual comprehension and fluency; a leading hypothesis to explain this finding is that reading groups have subcultures that differentially support paying attention. The most newsworthy finding of the study was the sharp drop in attention after oral reading errors; this drop was observed in all reading groups in both 2nd and 3rd grades.

Our premise is that attention in classrooms is inherently a dynamic process that unfolds over time. No doubt the attention being displayed at any moment is the result of many forces: the traits of students and teachers, classroom organization, routines that govern conduct and work. However, beyond factors that for any limited episode can be considered fixed, the working hypothesis of this article is that attention changes moment by moment in response to classroom events. This is the sense in which we say that attention is dynamic.

Attention is a construct with a checkered history in psychology. The term was not even admissible during the behaviorist era. Over the past two decades, *attention* has been readmitted to the psychologist's lexicon. The major accomplishment during this period has been the refinement of the concept of *automaticity*, the theory that frequently repeated mental processes require little attention (cf. Schneider & Shiffrin, 1977). This research is fascinating but, as far as we can see, largely irrelevant to attention in classrooms. Classroom research is better served by concepts about attention that have origins in another era of psychology. According to William James (1890), *attention* is "taking possession by the mind, in most clear and vivid form, of one out of what seems several simultaneously possible objects or trains of thought" (p. 453). In other words, James emphasized that attention is selective, and this is the feature of attention we emphasize as well. We attempt to build a partial model of the network of factors that determine students' selective attention.

Because the construct of attention comes from psychology, one is predisposed to account for attention in terms of properties of individuals. However, our starting assumption, subject to empirical verification, is that attention arises as much from the social logic of groups as from the inner logic of individuals. The unit of social organization for reading instruction in most U.S. primary classrooms is the reading group, a subgroup of children in a class selected to be more or less homogeneous in ability. Sharp differences in the behavior of students and teachers in low, middle, and high reading groups have been documented (Barr & Dreeben, 1991; Hiebert, 1983; Weinstein, 1976). The leading theory to explain the variation in behavior is that reading groups have different subcultures that reinforce different norms of behavior (Cazden, 1985; McDermott, 1978). However, the still-defensible alternative theory is that the behavior of a reading group is predictable in terms of the traits of its members.

To be useful in classroom research, the very definition of attention must be social and normative. We say that a student is attentive if the student is looking where he or she is supposed to be looking. In a traditional classroom, "supposed to be" can be further defined in terms of the explicit or implicit intention of the teacher. During a conventional small-group reading lesson, most often, looking at a page from the day's story counts as attention; less frequently, looking at another person in the group who is speaking counts as attention, provided that the speaker has a right to speak, considering operative norms.

Attention in classrooms can be conceived as part of a network of interacting factors. It is useful to categorize factors as antecedent, concurrent, and consequent. *Antecedent* factors are more or less fixed prior to a certain series of lessons. Examples of antecedent factors are children's gender, reading level, and reading-group membership. To be sure, level and group membership do change, but the likelihood of dramatic

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We gratefully acknowledge the assistance of Clark Chinn, Bonnie Kerr, Marlene Schommer, Ellen Weiss, Phillip Wolff, and Jana Mason.

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change is low during a single lesson or a series of consecutive lessons. *Concurrent* factors vary within and across a given series of lessons. An example of a concurrent factor that may vary from lesson to lesson is the difficulty of the stories the children read. Examples of concurrent factors that may vary within a lesson are the page-by-page difficulty of the story and the measured fluency of the children called on to read the pages aloud. Other concurrent factors, such as whether the oral reader of the moment makes an error on a sentence being read, vary on an even finer time scale. *Consequent* factors follow, and are conditional on, episodes of attention during a certain lesson or series of lessons. Examples include changes in the teachers' behavior, mastery of material covered in the lesson, and transfer of abilities that may have been enhanced. In this study we consider selected antecedent and concurrent factors and their interactions, and we attempt to gauge how these factors influence attention moment by moment.

The percentage of time students spend paying attention—looking where they are supposed to look, doing what they are supposed to do—is a good predictor of reading achievement. For example, Lahaderne (1968) observed for 37 hr over a 2-month period in four sixth-grade classrooms, scanning the students repeatedly and recording whether each was attentive or inattentive. She found that the percentage of time students were attentive during the period of observation correlated from .39 to .51 with their scores on reading tests. Samuels and Turnure (1974) completed a similar study in first-grade classrooms with comparable results; attentiveness correlated .44 with a reading measure. These two studies are representative. Rosenshine and Stevens (1984) located ten classroom studies of attention completed during the past 25 years and found that the average correlation between measures of attention and measures of reading was about .40.

Whereas previous classroom studies suggest that attention may play an important role in academic success, most of these studies have treated attention as though it were a static trait of students that is invariant across time and context. To the best of our knowledge, only three studies have examined what concurrent, situational factors affect students' attention: Cazden, 1973, cited in Cazden, 1981; Eder and Felmlee, 1984 (see also Felmlee & Eder, 1983; Felmlee, Eder, & Tsui, 1985); and Hess and Takanishi, 1974.

Hess and Takanishi (1974) examined student "engagement" in 39 elementary school classrooms during mathematics and language arts instruction. They found that student engagement was strongly related to teacher behavior but not to classroom architecture (self-contained vs. open space), nor to student characteristics such as age, gender, and ethnicity. Moreover, engagement was not related to specific teaching strategies, such as frequency of feedback or types of question, but to the social organization of the classroom, such as group size and degree of teacher involvement. Hess and Takanishi found greater engagement when children were working in small groups and when children were working with the teacher rather than with other students or alone with materials.

Cazden (1973, cited in Cazden, 1981) observed students in 10 primary-grade classrooms while they were watching random episodes of a popular children's television program, *The Electric Company*. Attention was coded with two independent measures: (a) a group measure, which entailed scanning the entire class at 30-s intervals and counting the number of children who were visually oriented toward the television screens, and (b) an individual measure, which entailed continuously monitoring and recording the visual attention of each student. Among the interesting findings emerging from this study were that children in more highly structured classrooms showed greater attention and that attention was related to children's individual reading abilities (the relationship was curvilinear). Even more interesting was the finding that attention was related to reading-group membership. Pooling data across classes, Cazden found that children of the same tested reading level showed less attention and more attention shifts when they were in low reading groups than when they were in high reading groups. In other words, reading group assignment affected attention above and beyond individual reading level.

Eder and Felmlee (1984) reported a similar finding. They coded attention continuously from videotapes of four lessons from the high and low reading groups in a single first-grade classroom. The interesting conclusion reached by Eder and Felmlee (1984) was that reading group membership had

> a strong and significant effect on student attentiveness. By doing a quantitative analysis we were able to show that this effect is due to differences in group environments rather than to differences in individual characteristics or amount of teacher management. (p. 207)

One shortcoming of the Cazden (1973, as cited in Cazden, 1981) and Eder and Felmlee (1984) studies undermines confidence in the conclusion that attention depends on group membership rather than on individual reading level or other individual characteristics. In both studies, the measure of reading level was a single test: a standardized reading test administered in second grade in Cazden's study and a reading readiness test administered in kindergarten in Eder and Felmlee's study. Thus, individual reading ability may have had weak effects because it was weakly measured. In the present study, we painstakingly measured reading levels. This should enable a better answer to the question of whether the reading level of individual children or the culture of reading groups has the stronger influence on attention.

Another interesting finding reported by Eder and Felmlee (1984, Table 3, p. 196; Felmlee et al., 1985, Table 3, p. 224) was that in some analyses a high rate of oral reading errors was associated with a lower likelihood of lapses in attention. This flies in the face of common sense in the field of reading. Nonetheless, on the basis of the Eder and Felmlee finding and our own circumstantial evidence, Anderson, Wilkinson, Mason, Shirey, and Wilson (1988) conjectured that an oral reading error may give rise to "a tension that increases attention and instigates deeper processing" (p. 271). The present study was designed to provide dependable evidence about the relationship between oral reading errors and attention. It is likely that individual reading level, group membership, or both are associated with attention and oral reading errors. Therefore, simply studying the association between attention and naturally occurring oral reading errors would confound oral reading errors with individual reading level or group membership. In this study, one gambit used to disentangle oral reading errors from reading level and group membership was to manipulate text difficulty experimentally.

To recapitulate, the general purpose of the research reported in this article was to explore attention moment by moment during reading lessons and to investigate some of the factors, concurrent as well as antecedent, that may influence attention. The specific purpose was to disentangle the influences on attention of individual reading level, group membership, and oral reading errors.

Method

Subjects

One hundred and sixteen students (56 girls and 60 boys) participated in the study. They were enrolled in either a second-grade or a third-grade classroom from each of three schools in east central Illinois. The schools were chosen so that the sample would be as diverse as possible: one was in a rural, farming area; the second was in a low-income area of a small city, and the third was in a middle-class area of another small city. Eighty-one of the students were White, 22 were Black, and 13 were of other ethnic backgrounds. A standardized comprehension test was administered in the fall when the study was conducted: On the reading comprehension test from the Metropolitan Achievements Tests (MAT) the students had an average stanine of 5.9, with a standard deviation of 1.8, which compares with a national average of 5.0 and a national standard deviation of 2.0.

Design and Materials

In each of the six classes participating in the study, there were three reading groups. As a part of the study, each group received four lessons that featured one of four texts. Hence, altogether the study involved 72 lessons (6 classrooms × 3 reading groups × 4 texts), each of which was videotaped.

The difficulty of the texts was manipulated in a within-subject design. Difficulty was determined by three judges who selected stories of representative difficulty and interest from among first-grade through fifth-grade basal anthologies that were not in use in the cooperating schools. Each reading group received four stories ranging over four grade levels. The easiest story was one grade level below the children's current nominal grade level; the second easiest was on the current grade level; the third easiest was one grade level above the current grade level, and the most difficult was two grade levels above the current grade. The stories were edited as necessary to be exactly 10 pages in length. Each group read one story a day for each of 4 days. The four stories were read in order of increasing difficulty from the easiest to the most difficult. This was done so as not to discourage students with the most difficult texts at the beginning. As a result, however, order was confounded with text difficulty.

Procedure

The format of the lessons involved the children taking turns reading pages of one of the stories aloud, with help from the teacher as needed, followed by brief discussions in which the children answered questions, mostly about story details and word analysis. The lessons were taught by the regular classroom teachers, all of whom indicated that they usually asked children to take turns reading segments of stories aloud during small-group lessons. The teachers were provided with a brief lesson guide prepared by the research team. During the study, every reading group completed one story each day. This was a faster pace than normal for the low groups in the participating classrooms, especially when they were reading the difficult stories. A member of the research team videotaped every lesson. After the lessons individual oral retellings of the stories were collected; these data have not been analyzed and are not reported in this article.

Scoring of Attention and Reading Errors

The attention of every child in a group, including the child reading aloud, was scored moment by moment throughout the reading turns in the lessons. A *reading turn* was defined as the interval that began when the teacher nominated a child to read aloud a page of text and ended when the child had finished the last word on the page. Because there were 72 lessons and 10 reading turns within each lesson, there were 720 intervals during which attention was evaluated.

Trained raters coded attention with the aid of a computer program. The rater followed one student at a time on the videotape of the lesson, pressing a key on a computer terminal whenever the student shifted from a state of attention to a state of inattention, or vice versa. The computer program calculated the duration of each state and also compiled the database, keeping track of the student's attention and individual characteristics, group characteristics, and text characteristics. The basic criterion for attention was whether the student was looking at the place he or she was supposed to look at the moment: When the reader was reading the text, the student was supposed to look at the text; when the reading was interrupted by an error, teacher feedback, or both, it was considered attention if the student was looking at the text, the reader, or the teacher. To check interrater reliability, six raters scored the attention of 20 children from different groups reading different stories. The average Pearson product–moment correlation among the attention durations recorded by the six raters was greater than .95. Altogether, about 8,000 episodes of attention, ranging in duration from 1 s to several minutes, were recorded.

Oral reading errors were also scored from the lesson videotapes by trained raters. The raters used an error analysis scheme similar to the one developed by Hoffman et al. (1984). Four raters averaged 72% agreement in a reliability check, which was adequate but not as high as we might have hoped. For the main data analysis, an *oral reading error* was defined simply as any deviation from the text. About 3,000 oral reading errors were recorded that fit this broad definition. The raters also recorded various features of each error, such as its degree of semantic and graphophonemic overlap with the correct word; whether the teacher provided feedback; and if feedback was provided, whether the feedback was terminal or sustaining. These features were considered in subsidiary analyses. The raters recorded the time at which each error occurred. The time was read from a digital clock display encoded on the videotape. This enabled precise calibration with the attention data.

Individual Differences in Reading Level

Five measures were used to assess students' level of reading comprehension and fluency. These were the following: (a) scaled scores from the reading comprehension subtests from the MAT, Primary 1 and Primary 2, Forms L (in the standardization sample, K-R 20 = .93 for both levels; Prescott, Balow, Hogan, & Farr, 1986); (b) scaled scores from the reading comprehension subtest of the Illinois Goal Assessment Program (IGAP; in a standardization sample, coefficient α = .84; Valencia, Pearson, Reeve, & Shanahan, 1988); (c) teachers' ratings of students' comprehension measured on a 6-point Likert scale (factor loadings with other measures of comprehension from the study sample provided lower-bound estimates of reliability, which were .86 for Grade 2 and .68 for Grade 3); (d) time, in hundredths of a second, to read two passages from the Gray Oral Reading Tests–Revised (in the study sample, coefficient $\alpha = .92$ for Grade 2 and .89 for Grade 3; Weiderholt & Bryant, 1986); and (e) time, in hundredths of a second, to pronounce two lists of pseudowords adapted from Stanhope and Parkin (1987) and Stanovich, Cunningham, and Feeman (1984) (in a study sample, coefficient $\alpha = .90$ for Grade 2 and .81 for Grade 3). We took the mean of reading times on the two passages and the mean of pronunciation times on the two lists of pseudowords.

These measures were used to estimate comprehension and fluency factor scores. The factor scores were computed in three steps. First, when necessary, measures were transformed by applying normalizing transformations. Scaled scores from the IGAP were expressed as proportions of the total possible score and measured in radians following an arcsine transformation (2 arcsine $\sqrt{P}$). Mean passage reading time and mean pseudoword pronunciation time were normalized by taking natural logs, and the scales were inverted so that high scores indicated high fluency.

Second, any missing data on the measures were estimated using ordinary least-squares regression. The data were missing on one or two measures for 10 subjects. When possible, comprehension measures having missing values were regressed on the remaining comprehension variables and grade, and fluency measures having missing values were regressed on the remaining fluency variables and grade. For each subject having missing values, estimated scores on the variables were computed by substituting values of variables for the subject into the regression equation and solving the equation.

Third, a two-factor model was fit to correlations among the five measures. The comprehension factor was indexed by the MAT, the IGAP, and teacher ratings, as well as by passage reading time; these measures had factor loadings of .88, .69, .68, and .44, respectively. The fluency factor was indexed by pseudoword pronunciation time and passage reading time, and these measures had factor loadings of .89 and .60, respectively. The correlation between the factors was .65. This yielded a $\chi^2(4, N = 116) = 3.28$, $p = .51$, root mean square residual $= .03$. The fit was significantly better than that of a one-factor model, difference $\chi^2(2, N = 116) = 33.93$, $p < .01$. Estimated factor scores for comprehension and fluency were computed by the regression method and converted to local stanines. The estimated factor scores were approximately normally distributed. Comprehension and fluency scores correlated .76. Table 1 summarizes the factor scores of the children in each reading group.

Variables

The variables measured during the study and included in the data analysis were as follows: *Grade* was coded according to whether children were in Grade 2 or Grade 3. *Comprehension* factor scores were expressed in local stanines. *Fluency* was also a factor score scaled as a stanine. For *gender*, boys were coded 1, and girls were coded 0. For *ethnicity*, children from ethnically mainstream homes were coded 1, and nonmainstream children, including Blacks, Hispanics, and Asians, were coded 0. For *group*, high, middle, and low reading-group membership was coded 3, 2, and 1, respectively, permitting an investigation of the linear component of group membership.

The *difficulty* variable pertained to text difficulty, which was represented on a 4-point scale ranging from *one grade below level* (1) to *on grade level* (2), to *one grade above level* (3), to *two grades above level* (4). As with reading group, this coding allowed for an assessment of the linear component of text difficulty. The *page* variable was measured by the serial position of pages within stories and was coded 1 through 10. *Prior inattention* was coded 0 if a child had not been inattentive during a reading turn and 1 if the child had previously been inattentive one or more times during this reading turn. *Error* was coded 1 when the current state of attention terminated within 5 s of an oral reading error; otherwise it was coded as 0. *Previous time* is the time in seconds from the beginning of a reading turn until the onset of the current episode of attention.

Table 1
Group Size and Reading Aptitude by Class

Class/ reading group	n	Comprehension M	Comprehension SD	Fluency M	Fluency SD
Grade 2					
Class A					
Low	3	0.72	0.93	0.71	1.23
Middle	10	4.33	0.42	5.04	0.88
High	5	6.13	1.76	5.85	1.66
Class B					
Low	3	1.64	1.41	1.35	0.61
Middle	6	3.08	0.93	2.53	1.24
High	7	6.68	1.39	4.83	1.63
Class C					
Low	7	2.06	1.63	1.61	1.64
Middle	8	5.12	1.02	4.50	1.05
High	9	6.72	1.03	5.22	1.15
Grade 3					
Class D					
Low	8	3.29	1.18	5.28	1.38
Middle	6	5.43	0.77	5.71	1.01
High	5	6.07	0.60	6.88	0.99
Class E					
Low	3	3.74	1.00	3.94	1.54
Middle	9	5.65	1.34	5.74	1.25
High	6	7.55	1.39	6.85	0.98
Class F					
Low	4	4.54	0.95	5.67	0.97
Middle	6	5.12	0.48	6.13	1.10
High	11	6.57	1.20	6.91	0.96

Note. Measures of reading aptitude are estimated factor scores expressed in stanines.

Approach to Analysis

To explore attention as a dynamic process, rather than as a static trait, we used *event history analysis*. An *event history* is a longitudinal record of the times at which events happened among a sample of individuals or other entities. An event is a change of state. The change of state with which we were concerned was a shift from attention to inattention. Each student's history of attention shifts was recorded, and we examined the relationships between attention shifts and various factors. Three characteristics of event history analysis make it the statistical method of choice.

First, attention shifts are discrete events. These are coded with a dummy variable indicating whether the event (in this case, a shift from attention to inattention) has occurred. Hence, a discrete-state model is required, as opposed to a model suitable for continuous dependent variables, such as ordinary least-squares regression analysis.

Second, attention shifts can occur with some probability at any point in time. In other words, the data provide information not only about whether an event occurred but also about the timing of the event, given that it occurred. Event history models exploit the continuous-time aspect of attention.

Third, event history analysis accommodates so-called censored events, which constitute a problem for standard statistical procedures when these are applied to time data. *Censored events* are observations that must be discounted because of factors that are irrelevant to the issue being studied, for instance, a patient in research on cancer who dies, not from cancer, but in an automobile accident. In our study, no fewer than one third of the total observed number of episodes of attention were censored because a turn ended when the child finished reading a page, and a few additional observations were censored when children left the room for remedial instruction, when lessons were interrupted by announcements over the public address system, or when other such distractions occurred. Simply discarding these observations would have led to severe bias (Tuma & Hannan, 1978). Event history analysis allows estimation of parameters with censored cases included in the data. The analysis produces estimates that are asymptotically unbiased and that also have good small-sample properties with moderate degrees of censoring (Tuma & Hannan, 1978).

To make the problematic status of censored observations intuitively clear, consider an educational illustration (Willett & Singer, 1988). Suppose one wants to estimate the length of time it currently takes people to get PhDs in various fields. It should be obvious that one cannot base the estimate solely on the data of people who already have their degrees, discarding the data of people who still are degree candidates, or one will underestimate the length of time.

Reflecting the origins of event history analysis (or survival analysis, as it is also called) in biomedical research, the basic descriptive summary of event data is called a *life table*. For an illustration of how a life table is constructed, imagine that a cancer researcher follows 100 patients for a period of 5 years from the point at which cancer is diagnosed and examines the relationship between the likelihood of the "event" of a patient's dying and factors such as type of treatment, gender, and age. During Year 1, suppose that 13 patients die of cancer. The *hazard rate* during the first year is the proportion who die, or .13. The *survival rate* at the end of the first year is the proportion still alive, or .87. During Year 2, an additional 17 patients die of cancer. Only the 87 who survived the first year are still at risk; therefore the hazard rate for the second year is 17 divided by 87, or a little less than .20, and the survival rate is a little more than .80.

In our case, the variables of interest were the proportion of children during a lesson who were still attentive after a period of time and, conversely, the proportion whose attention lapsed during this period. The unit of time was the second rather than the year; otherwise, the construction of a life table was the same as in the cancer example. Also, inattention is more like a skin disease than cancer, in the sense that children were observed repeatedly and many suffered from recurrent episodes of inattention. This meant that each child contributed multiple observations to the database.

In addition to life table analyses, we performed multivariate analyses, using the proportional hazards model developed by Cox (1972; see also Allison, 1984). The dependent variable was the hazard rate, in our case, the probability that an attentive child would become inattentive during a certain interval of time. The hazard rate was allowed to depend on time, time-invariant explanatory variables, and time-varying explanatory variables. The basic model is as follows in the two-variable case:

$$\log h(t) = a(t) + b_1x_1 + b_2x_2(t),$$

in which $\log h(t)$ is the log of the hazard rate, x_1 is a time-invariant explanatory variable, x_2 is a time-varying explanatory variable, and $a(t)$ is any function of time. The coefficients b_1 and b_2 give the hazard rate change in logarithmic units for one-unit changes in x_1 and x_2. The estimation procedure Cox proposed is a derivative of maximum likelihood called partial likelihood estimation. The procedure works by representing the problem as two factors: One factor contains information only about the coefficients b_1 and b_2; the other contains information about b_1, b_2, and $a(t)$. Partial likelihood estimation simply discards the second factor and treats the first factor as though it were an ordinary likelihood function. This first factor depends only on the order in which events occur, not on the exact times of occurrence. The proportional hazards model has been widely employed by researchers, because it avoids the difficulty of specifying a priori how the hazard rate depends on time.

The proportional hazards model gets its name from the assumption that the ratio of the hazard functions for any two individuals in the population is constant over time. The model is robust in the face of violations of this assumption (for example, see Kalbfleisch & Prentice, 1980, pp. 89–95). Nonetheless, we checked for violations by comparing log–log plots of survival rates as a function of time for all of the major subdivisions of the data. Departures from proportionality were small with one exception. The exception was whether the child had displayed one or more previous episodes of inattention during the current reading turn. The problem was solved in this case by stratifying the analysis on the factor of prior episode of inattention (see Allison, 1984, p. 39). Smaller departures from proportionality were observed for grade and reading group. The problem was solved in this case by including the term *time dependence*, which represents variation between grades and reading groups in attention lapse rates as a function of the duration of episodes.

Results

The overall characteristics of attention during reading turns are displayed in Figure 1. The top curve shows the proportion of children who were continuously attentive moment by moment during reading turns. This curve, traditionally called a cumulative survival function, is simply a line drawn through the proportions observed during successive 5-s intervals. The bottom curve shows the rate of lapses in attention, or the hazard rate, as it is traditionally called, during successive 5-s intervals. The bottom curve is a smoothed function, and the points around the curve represent the observed values. Henceforth, the figures show only the proportion of children still attentive, because this measure is perhaps more easily understood than attention lapse rate (Willett & Singer, 1988) and because the two measures embody basically the same information.

Notice that attention declines sharply over the first 15 s and then levels off. The same pattern appears in all subgroups under every condition in the study. Evidently children are most vulnerable to becoming inattentive in the early moments of episodes of attention. Because most of the data represented in Figure 1 come from short episodes of attention, the values plotted in the figure are more stable at short durations than at long durations. As a rule of thumb, the values are very trustworthy at durations up to 60 s, fairly trustworthy at durations from 61 to 90 s, and less trustworthy at durations greater than 90 s.

Table 2 summarizes the principal multivariate analyses of attention lapse rate. In each model, the data have been stratified according to whether the child has previously been inattentive during the reading turn. The coefficients and standard errors are expressed in logs.

The first model presented in Table 2 shows the influence of antecedent factors representing characteristics of the children. Four of the five factors included in Model 1 had a

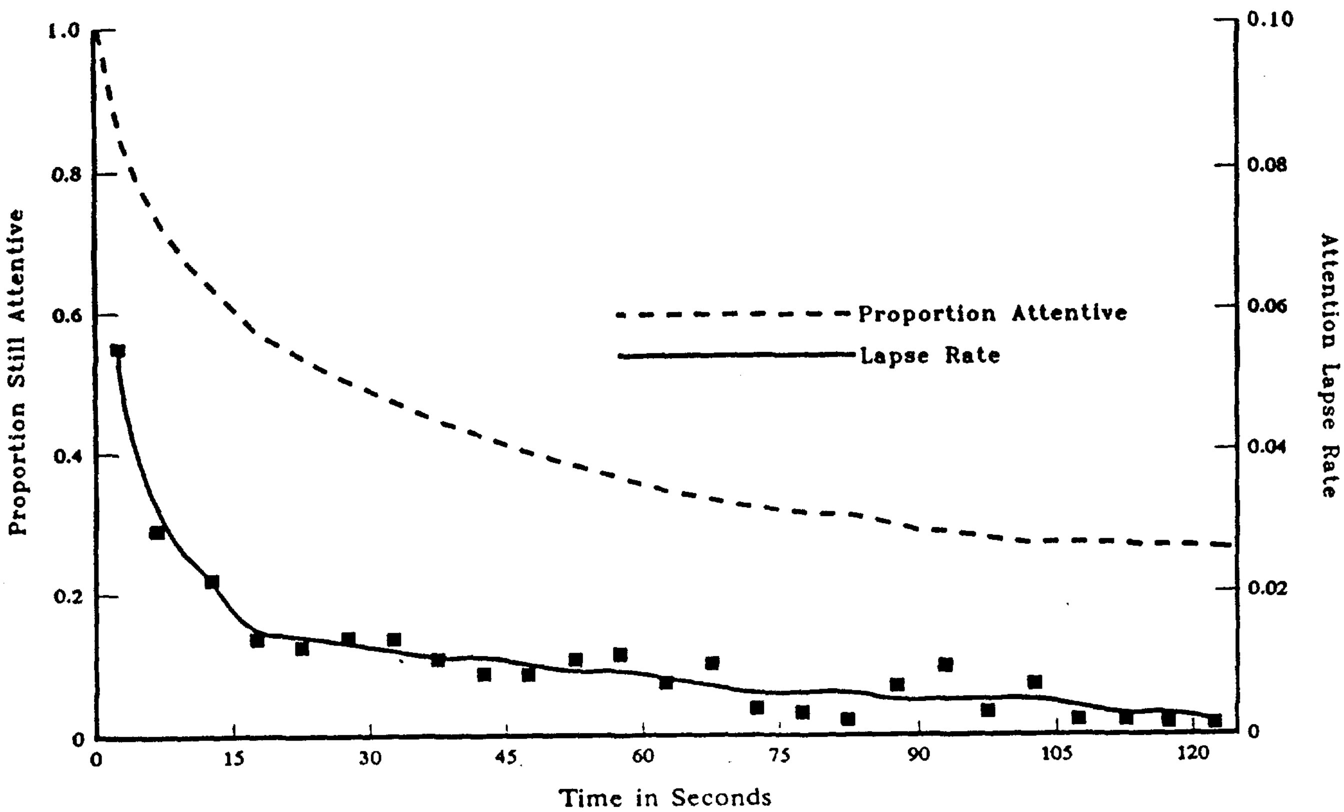

Figure 1. Proportion still attentive as a function of time.

significant influence on attention. Third graders were less likely to become inattentive than second graders (cf. Figures 2 and 3); children high in comprehension and fluency were less likely to become inattentive than children who scored low on these factors; and, as is depicted in Figure 4, girls were less likely to become inattentive than boys.

Group was entered in Model II and proved to have a pronounced effect on attention. Figures 2 and 3 show the proportions of children still attentive at successive 5-s intervals throughout a reading turn for the three levels of group within Grades 2 and 3, respectively. It is apparent that group membership has stronger effects on attention than does individual reading level. In comparing Model I with Model II, it is evident that the influence of fluency has been attenuated, whereas the influence of comprehension has vanished altogether, and neither factor remains significant.

In Model II, and in each subsequent model, ethnicity was significant. Ethnically mainstream children were more likely to have lapses of attention than nonmainstream children, everything else being equal.

Two concurrent factors that encode features of the materials were entered in Model III. The difficulty of the stories had a significant influence on attention, whereas the serial position of a page within a story did not. Figure 5 shows that attention generally declined as the difficulty of the stories increased.

Model IV is identical to Model III, with the exception that Model IV includes two additional concurrent factors, which encode features of the moment-by-moment transactions during reading turns. The results indicate a striking increase in lapses in attention within 5 s of oral reading errors. Indeed, oral reading errors had by far the strongest effect of any factor investigated in this study. Children were over 2.5 times as likely to become inattentive during the 5-s interval after an oral reading error as they were during an interval in which there was no error.

A comparison of Model III and Model IV reveals that the size of the effects of most other factors were attenuated in Model IV. For instance, the coefficient for group drops from −.223 to a much smaller but still significant −.097. This suggests that oral reading errors mediate part of the influence on attention of the other factors included in the study. For instance, this result suggests that one reason, although not the sole reason, that high groups are more attentive is that members of these groups make fewer mistakes when reading aloud.

Model V adds selected interactions. The Grade × Group interaction is represented in Figures 2 and 3. The Group × Difficulty interaction appeared because story difficulty had a greater effect on attention in low-aptitude than in middle- and high-aptitude groups. The Grade × Difficulty interaction appeared because difficulty had a greater effect on the attention of second graders than on the attention of third graders.

Model VI is the same as Model V, except for the addition of time-dependence in Model VI. The purpose for including this term was to correct for slight nonproportionality. The correction term was significant, confirming the impression from the log–log plots of survival functions. However, the fit of the model improved only slightly over that of Model V, and the coefficients for the factors in the model were similar

Table 2
Six Models of Attention Lapse Rate

Variable	Model I *b*	Model I *SE*	Model I *b/SE*	Model II *b*	Model II *SE*	Model II *b/SE*	Model III *b*	Model III *SE*	Model III *b/SE*	Model IV *b*	Model IV *SE*	Model IV *b/SE*	Model V *b*	Model V *SE*	Model V *b/SE*	Model VI *b*	Model VI *SE*	Model VI *b/SE*
Grade	−.176	.041	−4.260**	−.264	.043	−6.119**	−.260	.043	−6.013**	−.171	.044	−3.868**	−.217	.129	−1.684	−.387	.135	−2.862**
Comprehension	−.064	.015	−4.293**	−.004	.017	−0.249	−.006	.017	−0.335	−.027	.017	−1.577	−.017	.017	−1.551	−.023	.017	−1.311
Fluency	−.036	.015	−2.391*	−.029	.015	−1.924	−.030	.015	−1.958	−.001	.015	−.051	.007	.016	0.417	.003	.015	0.212
Gender	−.104	.032	−3.237**	−.083	.032	−2.567*	−.086	.032	−2.669**	−.080	.032	−2.487*	−.093	.033	−2.858**	−.094	.033	−2.883**
Ethnicity	.056	.037	1.505	.082	.037	2.186*	.087	.037	2.332*	.098	.038	2.597**	.107	.038	2.841**	.107	.038	2.855**
Group				−.224	.033	−6.903**	−.223	.033	−6.866**	−.097	.033	−2.952**	−.240	.128	−1.871	−.291	.129	−2.265*
Difficulty							.066	.014	4.615**	.036	.015	2.431*	.259	.078	3.309**	.258	.078	3.295**
Page							.006	.005	1.168	.009	.005	1.722	.008	.005	1.612	.009	.005	1.674
Error										.999	.034	29.215**	.990	.034	28.807**	.989	.034	28.836**
Previous time										−.001	.001	−1.685	−.001	.001	−2.244*	−.001	.001	−2.298*
Grade × Group													.099	.044	2.266*	.093	.044	2.120*
Grade × Difficulty													−.061	.030	−2.056*	−.060	.030	−2.020*
Group × Difficulty													−.042	.019	−2.237*	−.042	.019	−2.246*
Time dependence																−.034	.008	−3.996**
Log likelihood	−33,097.63			−33,073.80			−33,062.39			−32,659.78			−32,651.98			−32,643.97		
χ^2	280.48			320.56			341.60			1,365.47			1,394.39			1,411.99		
df	5			6			8			10			13			14		

Note. For all chi-square tests, N = 7,996.
* $p < .05$. ** $p < .01$.

regardless of whether the correction term was in the equation. The two largest changes were that grade and group were significant in Model VI but not in Model V.

Not shown in any of the models in Table 2 is the influence of prior episodes of inattention on the rate of attention lapses, because as indicated earlier, we stratified on prior inattention to correct for nonproportionality. Figure 6 shows that children who previously had been inattentive one or more times were much more likely to become inattentive again than were children whose attention had been sustained.

Also not shown in Table 2 is the effect of the number of children in a reading group. In an ancillary analysis that included the factors of grade, individual comprehension and fluency, gender, ethnicity, group level, and group size, there was a nonsignificant trend for small groups to have lower attention lapse rates than large groups. This is consistent with the findings of Dreeben and Barr (1987), who reported negligible effects of group size. We did not examine interactions with group size because there was no theory to guide the choice of which interactions to examine and because unguided exploration would have vitiated the power of the analysis.

Lag Between Reading Errors and Lapses of Attention

For one event to be called the cause of another event, the first event must occur before the second. Furthermore, the first event ought to precede the second event by an interval that is within the response time of the physical, psychological, or social system that encompasses the events. For instance, we would not want to say that flipping a switch caused an incandescent light to go out if it went out 5 min after the switch was flipped.

What is the response time of the system that relates one child's attention to another child's oral reading errors? An a priori basis for an answer would be difficult to find. Five seconds was a guess—as it happens, not a bad one—but now we may ask whether the peak response occurs at a longer or shorter interval. We investigated two additional intervals. The first was 2 s, which may be close to the error of measurement inherent in our procedures. The second was 8 s, which is enough time for the reader's own reaction to the error and teacher feedback to have an influence. The analyses revealed that rate of attention lapses increases strongly within 2 s of an oral reading error, more strongly within 5 s, and more strongly still when the interval is extended to 8 s. Thus, there is an immediate response to errors, and the response intensifies over time, at least through 8 s. This may indicate that part of the falloff in attention after an error is attributable to a chain reaction involving secondary events triggered by the error, such as teacher feedback.

Generality of the Effects of Reading Errors

The fact that the influence of reading errors on attention intensifies over intervals of up to 8 s leads one to surmise that the type of error, the reader's own reaction to the error, or the feedback the teacher gives to help the reader correct the error may be important. Accordingly, we completed further analyses to check these possibilities.

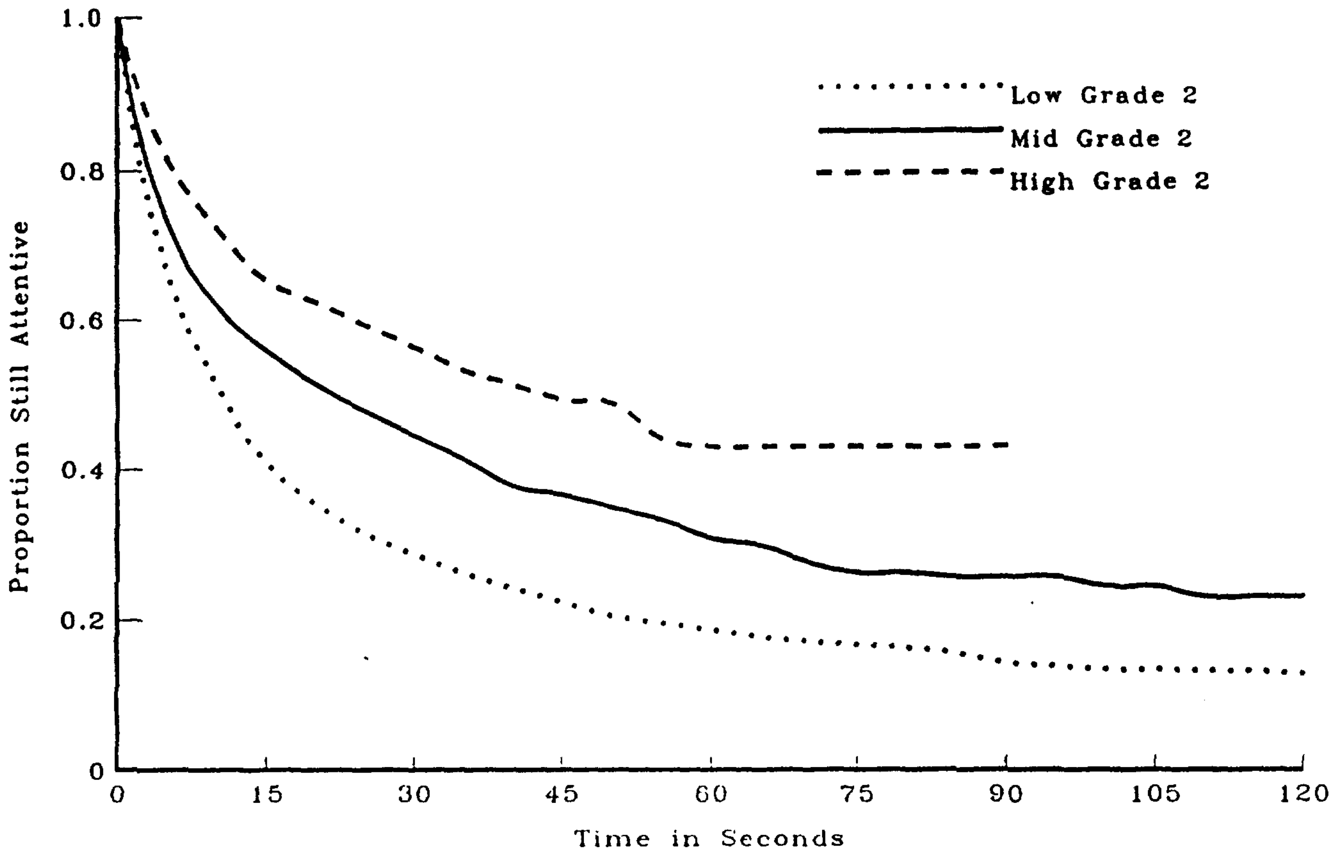

Figure 2. Proportion still attentive as a function of time and reading group in Grade 2.

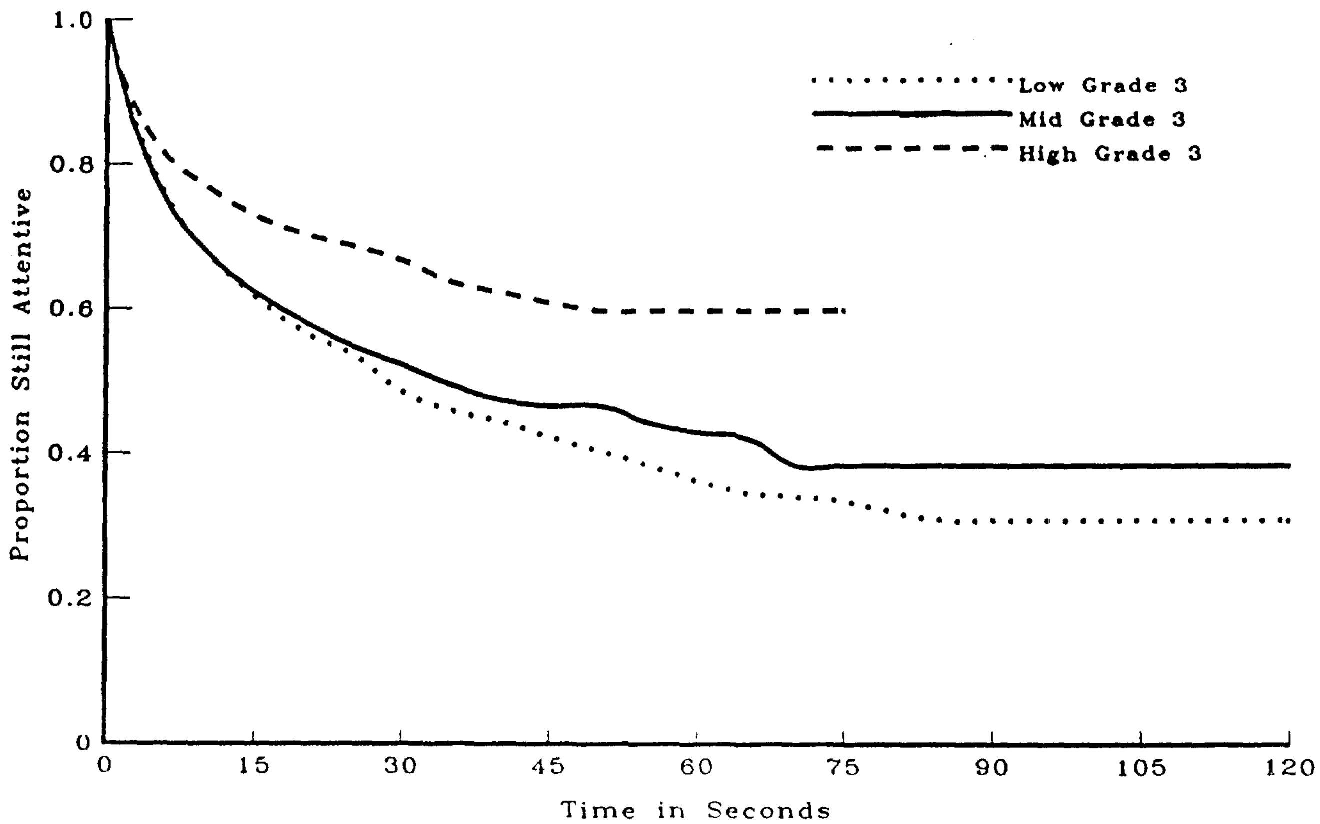

Figure 3. Proportion still attentive as a function of time and reading group in Grade 3.

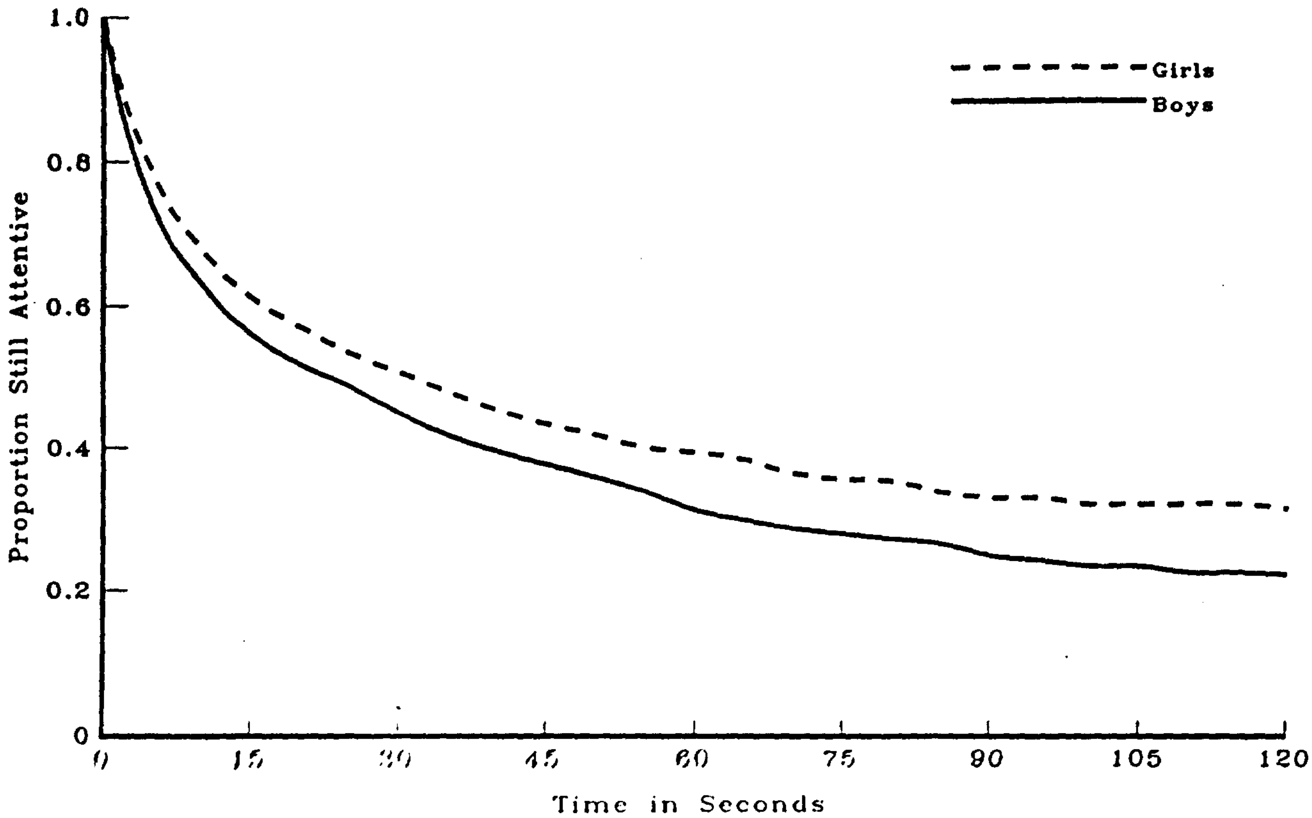

Figure 4. Proportion still attentive as a function of time and gender.

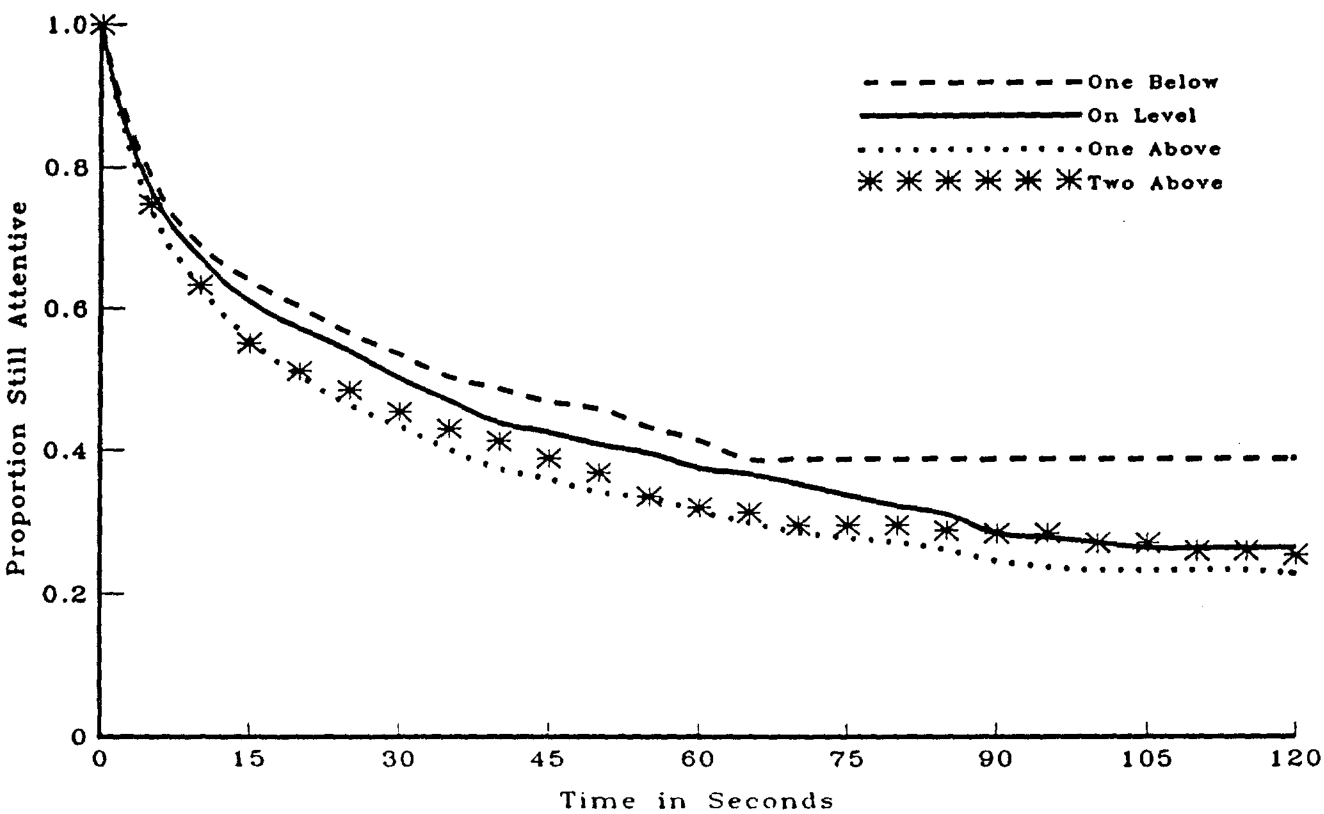

Figure 5. Proportion still attentive as a function of time and story difficulty.

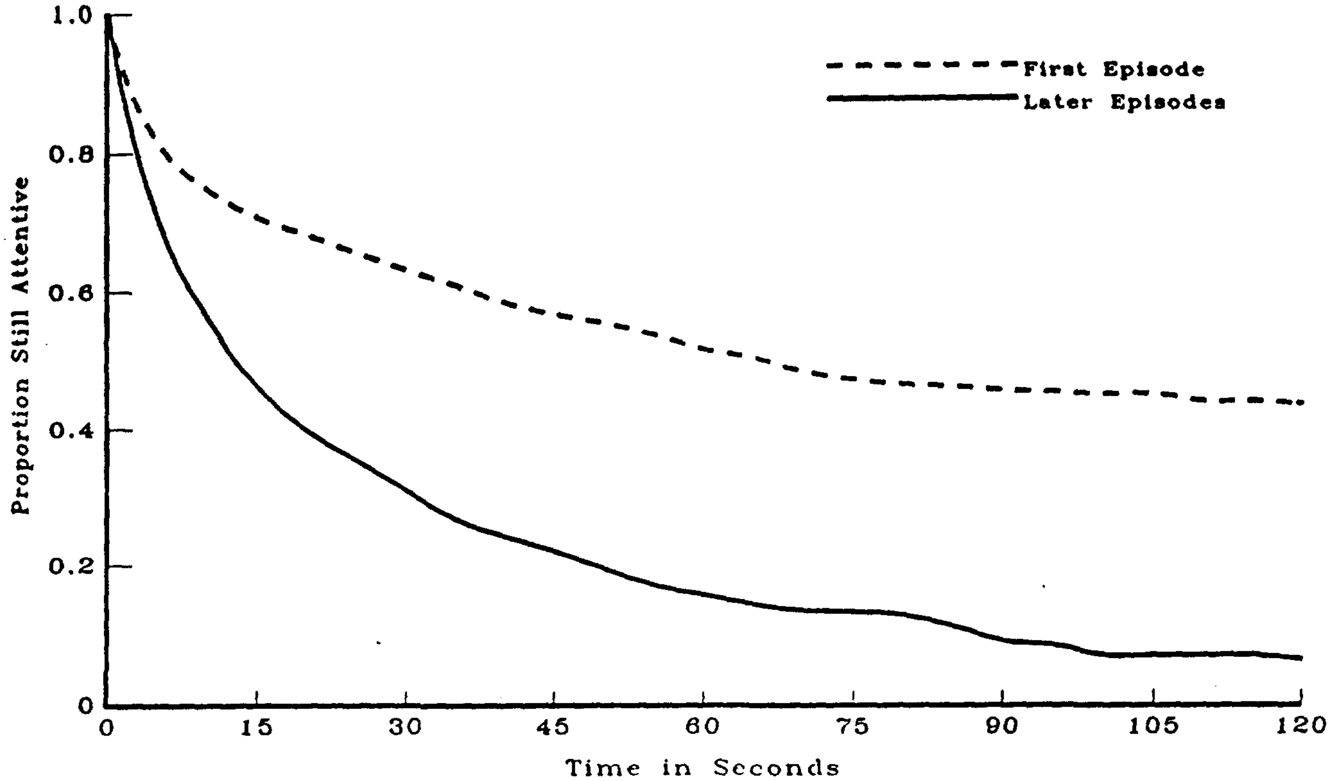

Figure 6. Proportion still attentive as a function of time and whether previously inattentive.

We were surprised to find that the likelihood of a lapse of attention seemed equally high whether the error response was semantically or graphophonemically similar to the correct word; whether the child paused following an error or kept reading; whether or not the teacher provided feedback, and whether, when feedback was provided, it was sustaining or terminal feedback. In other words, all patterns of error and feedback seemed to be approximately equal insofar as lapses of attention were concerned.

Investigating in one grand analysis whether there were interactions between the occurrence of reading errors and the other factors included in the study was not computationally feasible (estimating Model VI required nearly 20 min of mainframe central processing unit time). What we did instead was partition the data by group within grade and estimate simplified models. This analysis revealed that errors strongly increased the rate of inattention in all groups in both grades.

Evidently, oral reading errors have a pervasive, negative influence on attention. The influence does not appear to be conditioned by the nature of the error, the reader's own manifest reaction to the error, the teacher's feedback, group level, or grade.

Probability of Becoming Attentive

The analyses reported so far investigated the likelihood that attentive children would become inattentive. In an ancillary analysis not described in detail, we examined the likelihood that children who were currently inattentive would become attentive again. Except for the fact that the effects were weaker, the results of the ancillary analysis generally were mirror images of the results of the main analyses. For example, inattentive third graders were more likely to resume being attentive than inattentive second graders.

The chief difference between the two analyses was that, in the ancillary analysis, the serial position of pages within stories significantly influenced the likelihood of the children's becoming attentive, whereas the main analyses showed that the serial position of pages had no influence on the likelihood of becoming inattentive. Specifically, as a story progressed, children who had become inattentive were less and less likely to resume being attentive; however, over the course of a story, there was no change in the likelihood that children who were already attentive would remain attentive.

A conceivable objection to the conclusion that there is a strong relationship between reading errors and attention is that the relationship arises from an artifact in the method of scoring attention. One might conjecture that after an error, when a child made a transition from looking at the story to looking up at the oral reader or the teacher, the rater scored the transition as a moment of inattention. If this were true, children would have tended to resume being attentive very quickly after errors. In fact, errors were not significantly related ($p > .25$) to the likelihood that children would resume being attentive, and therefore the objection fails.

Discussion

Several intriguing findings emerged from this study. Most newsworthy was the sharp decline in attention following oral reading errors. The decline was evident within 2 s of an error and was even more pronounced after 5 s and 8 s. Because the study establishes that lapses of attention are highly likely just after oral reading errors, we venture the claim that errors are a proximate cause of inattention.

Errors undermined attention in every reading group in both the second and the third grade. The effect of errors did not appear to hinge on the nature of the error, the reader's own reaction to the error, whether the teacher provided feedback, or, when provided, the kind of feedback. Thus, the distracting effect of errors was pervasive as well as strong.

The finding that oral reading errors undermine attention conflicts with the results of Eder and Felmlee (1984), who reported that attention actually improved following errors. The difference in findings may be explained by the fact that they studied first graders, whereas we studied second and third graders. However, perhaps their finding should be discounted because it was based on 23 children from only one classroom. The present finding also conflicts with Anderson et al. (1988). Reasoning from circumstantial evidence, Anderson et al. hypothesized that oral reading errors might lead to increased attention under some conditions. The direct evidence from this study suggests that they were mistaken, at least under any of the circumstances investigated in this study.

A potentially controllable factor in whether children will make errors while they read is the difficulty of the text (Blaxall & Willows, 1984). Because errors lead to inattention, a decrease in story difficulty ought to lead to sustained attention, and indeed it did, especially for younger children in low reading groups. An interesting way of looking at the relationship between story difficulty and attention is graphed in Figure 7. The figure shows the profile of attention of average groups reading typical material for the grade and the profile of low groups reading material one grade level easier than typical for the grade. The two profiles are identical. Evidently, insofar as attention is concerned, low groups behave like average groups when the stories are easy enough. Also shown in Figure 7 is the attention profile of high groups reading material one grade level above their current grade. This curve is only slightly above the ones for the low and middle groups.

The child's grade and reading group level, the story's difficulty, and interactions among these factors all influenced attention. However, the size of these effects declined substantially once oral reading errors entered the equation. This suggests that one reason that these factors affect attention is that they affect the frequency of errors. In other words, errors appear to be on the causal path between these factors and attention.

That there is a negative association between errors on classroom tasks and growth in reading is a well-established finding (Anderson, Evertson, & Brophy, 1979; Fisher et al., 1978; Hoffman et al., 1984). On the basis of this finding, previous investigators have wanted to advance the conclusion that classroom tasks should be made easier so that errors are

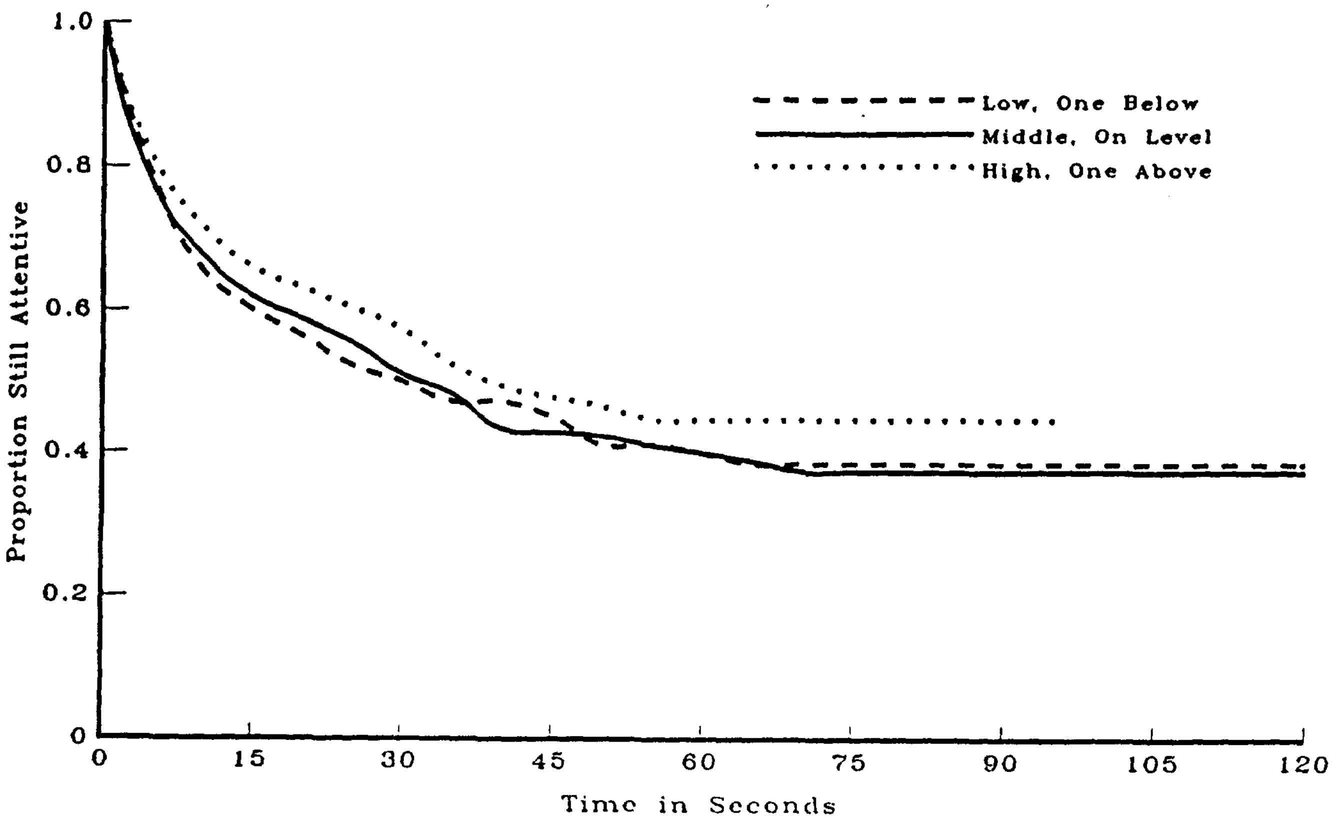

Figure 7. Joint effects of reading group and story difficulty on proportion still attentive as a function of time.

reduced. For example, although careful to reiterate that the evidence was only correlational, Hoffman et al. (1984) suggested that the long-time consensus in reading about the standard for gauging the instructional level of texts—whereby texts are suitable for use in teacher-guided instruction when students can orally read 95% of the words correctly—"may need to be revised to a higher success rate" (p. 381). A problem with this suggestion is that, without exception, the studies showing that errors are negatively correlated with growth in reading used highly fallible measures to adjust for differences among children in initial reading level. This means that, instead of being the cause of lower growth, error rate on classroom tasks may have correlated negatively with performance on a later achievement measure simply because it provided further information, beyond that contained in initial measures, about children's reading level (see Anderson et al., 1988).

The present study strengthens the case that oral reading errors are a cause of poor progress. First, the assessment of reading level entailed two facets of reading—comprehension and fluency—based on five varied and psychometrically strong measures. Thus, it is unlikely that the observed oral reading errors contained much residual information about individual children's reading level. Second, text difficulty was manipulated in a design that made it orthogonal to children's reading level. All children to some extent, but especially younger children and children in lower groups, were adversely affected by difficult texts.

Third, the study revealed a plausible mechanism by which errors may affect growth in reading: Oral reading errors undermine attention, and one may speculate that attention is a vital link in the chain that leads to growth in reading. The process can be diagrammed as follows:

Difficult texts → Errors → Lapses of attention → Slower growth

Of course, the present article does not report any evidence bearing on the putative link between lapses of attention and slower growth in reading. However, considering both the findings reported herein and previous findings, the diagrammed process seems to be a reasonable account.

Probably what happens when a text becomes too difficult and errors rise is that children's reading strategies break down and they become discouraged. From the point of view of children who are following along, probably an error breaks the continuity of the story. It signals a hiatus that will be neither interesting nor profitable, and hence attention is highly likely to lapse. If this is correct, then it is clear why a steady diet of texts on which children make a lot of mistakes would be boring, would undermine the children's self-confidence and interest in reading, and would retard their growth as readers.

However we do not wish to claim that if easy texts are good for children, even easier ones would be better. Nor do we wish to claim that, beyond the very earliest stages of learning to read, a low error rate—assured because, for instance, children can recite a text from memory—does much to promote growth in reading. For a lesson to promote growth, there must be what Clay (1987) called "reading work" for children to do. In Reading Recovery, the successful program pioneered by Clay for first graders who are failing to learn to read, a story is judged to be at a suitable level of difficulty if a child can correctly read between 90% and 95% of the words on a second reading of the story.

On the basis of their experience with Reading Recovery, Gaffney and Anderson (1991) concluded the following:

> At the heart of Reading Recovery instruction is the scaffolding the teacher provides to keep the child within his or her zone of proximal development. An important scaffold is selecting a book of just the right level of difficulty. Too difficult a book and a child may flounder. Too easy a book and the child will not have enough productive "reading work." The difficulty of a book is affected by such factors as whether it has a predictable pattern, the extent to which the pictures illustrate the concepts, and the familiarity of the words. However, a book is not easy or difficult in and of itself. For a child having trouble learning to read, the difficulty of a book can be intelligibly discussed only in relationship to this particular child. . . . Moreover, whether a particular child will find a particular book easy or difficult depends upon the context in which the book is read and the conditions surrounding its use. (p. 187)

Reading Recovery is an individual tutorial program, and the 90%-95% success rate standard for instructional level stories cannot be generalized to group instruction in the classroom. However, it does seem possible to generalize the principle that stories should be neither too difficult nor too easy.

Another notable finding of the study was that nominal group ability level—represented simply as 1, 2, or 3—was more strongly related to attention than highly reliable individual comprehension and fluency measures. Indeed, once group membership entered the equation, neither of the individual factors was significant. We consider three explanations of this finding. These explanations are not mutually exclusive; more than one could be true in part.

First, and most plausible we think, based on everything that is known, is the explanation that high groups have a culture that supports attention, whereas the norms of behavior in low groups reinforce inattention. Indicative of differences in culture, considerable variation in instructional and social processes among high and low reading groups has been documented (Hiebert, 1983). In high groups, the children themselves sometimes police misbehavior and may coach others to pay attention. In contrast, low group children frequently distract one another. Teachers tolerate more interruptions of lessons of low groups than of high groups. Children in low groups respond less adaptively to difficulties than do children in high groups. When Butkowsky and Willows (1980) varied children's success and failure on reading tasks, the children in low groups displayed less persistence, attributed failure to factors beyond their personal control, and provided lower estimates of future success than did the children in high groups. Children would rather be in high groups than low groups, and their status among other children depends on the group to which they are assigned (Luchins & Luchins, 1948; Weinstein, 1976).

A second, rival explanation attributes variations in level of attention among reading groups to differences in the traits of the children who belong to the groups. The obvious form of this hypothesis is that teachers assign children to groups at the beginning of the year according to initial reading level. The explanation continues that, if there seems to be an effect of group membership beyond children's individual initial reading levels, it is an illusion that arises because the measure of initial reading level is not completely valid or reliable. On the basis of her or his daily experience with children's reading, the teacher corrects for errors of measurement of initial level when she or he assigns children to groups. If a child is sick, distracted or, in contrast, performs uncharacteristically well on a short test, the teacher can override this faulty test score information when composing groups. The effect—or so the argument goes—is that group membership represents a more valid assessment of the child's reading level than does an individual test score. This is a tenable explanation for previous findings, but it is untenable in the present study because of the care that we took in measuring individual reading levels.

Another form of the hypothesis that attributes differences among reading groups to the traits possessed by the members is that teachers may compose groups partly on the basis of noncognitive traits such as tendency to be cooperative, to work hard, to pay attention, and to stay out of trouble. The influence of group "ability" on attention may indirectly reflect these other student characteristics. The present study offers no grounds for accepting or rejecting this hypothesis.

Third, yet another explanation of the association between group membership and attention hinges on the demonstration that text difficulty leads to inattention, especially for less able readers. Children in low groups may routinely get texts that are too hard for them, and this may be the source of their trouble in sustaining attention. This hypothesis neatly fits the data from this study, glosses the findings of previous research, and has the virtue of pointing to a clear policy implication: Give low groups easier texts.

The last finding on which we will comment is the fact that the likelihood of lapses in attention was high during the first 15 s of episodes of attention and low thereafter. This was true in all groups under every condition in the study. Evidently, if children can be induced to sustain attention for 15 s, they will be hooked for the remainder of a reading turn. We do not know of any previous study that has reported this finding.

In this study, children's moment-by-moment attention during reading lessons proved to be very orderly and lawful. That we found order rather than disorder is no doubt attributable in part to the meticulous (and tedious!) approach we developed for analyzing attention. Whereas previous investigators have usually scanned all of the children in a classroom at intervals of 30 s or so, using videotapes, we were able to examine the behavior of children one by one, second by second. Then, we analyzed the data in a way that was capable of uncovering dynamic properties of attention.

An improved method certainly helped, but the method could not have revealed order unless attention were fundamentally a lawful phenomenon. Because attention seems to be an especially good proximal index, one that is sensitive to concurrent lesson events, we conjecture that teachers use attention as a major source of guidance for moment-by-moment decisions during lessons.

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Attention Spans of Children in School Classrooms,

Compared with Attention to Television

John C. Wright

Technical Memo 14 October 1993

Center for Research on the Influences of Television on Children

University of Kansas

This technical report is a write-up in October, 1993 of some informal pilot data collected in the fall of 1979 by students in an undergraduate class.[1] They were assigned to observe children in second- to fifth-grade classrooms in public elementary schools in Lawrence, KS. Observations were made only during primary instruction periods in language arts (reading) and quantitative concepts (arithmetic).

The purpose of the study, other than as a learning exercise for undergraduate students in a developmental psychology class, was to determine if the school learning environment was more or less powerful in sustaining children's focal attention than are children's television programs.

From the work of Daniel Anderson and collaborators, we know that the average length of a visual fixation of the television screen by preschoolers during Sesame Street is under one minute, though there is much variation across segments and among different children. The largest increments in attention span to TV appear between two and three years of age. The span appears to level off at about 8 years of age. At five years of age the average length of look was about 40 sec. The typical long looks (when the material was comprehensible and interesting) lasted 70 sec., but more than half of the looks were very short (under 5 sec.). These data are summarized in Anderson & Lorch (1983).

The classroom data comprising this report were collected by 24 undergraduate students, who were instructed to observe one child, selected at random for ten minutes, recording the times at which the child started and stopped focussing visual attention on work materials at the desk or on the teacher during didactic presentations. The student observers recorded 108 such ten-minute intervals. Six students each observed in four classrooms of the second, third, fourth, and fifth grades.

Like Anderson's visual fixation data with preschoolers, the distribution of look lengths was log normal. That is most of the looks lasted less than ten seconds. The average look length was 44 sec. in the second grade, 48 in the third grade, 47 in the fourth grade, and 49 in the fifth grade.

If one considers that short looks may result from momentary distractions and not full-blown interruptions of attention, we evaluated the longest 25% of the looks, to compare with Anderson's longer looks in preschoolers while watching television. Anderson's long looks were 60 to 80 seconds. The second graders in school averaged 85 sec.; third graders 91 sec.; fourth graders 90 sec.; and fifth graders 96 sec.

Implications of these data are:

1. That attention bouts, and perhaps attention span, for active mental processing of academic school work is comparable to duration of looks as children watch educational television.

2. That length of looks continues to increase with age in both contexts, but levels off by about 8 years of age.

3. That the duration of the smallest chunk of information that children are likely to process without losing focal attention under optimal conditions may be quite short, perhaps around 90 seconds for school-age children, and less for younger children.

4. That typical magazine-format educational programs like Sesame Street, where most instructional segments range from 90 to 120 seconds are probably well matched to preschoolers' attentional capacities.

Some limitations of these data are:

1. The students were not highly trained observers, and no observer reliability data were taken.

2. The sample is small and not formally randomized or stratified.

3. The operational definition of attending to a learning task was eyes on the source (teacher or paper materials), one that might tend to under- rather than over-estimate their duration of mental focus.

Footnote

1. The original data were never formally analyzed or written up. The author received a number of inquiries after he mentioned these results at a conference entitled Television and the preparation of the mind for learning on October 2, 1992 in Washington, DC, sponsored by the Department of Health and Human Services. In response to those inquiries this informal report of the 1979 data was prepared.

Reference

Anderson, D. R. & Lorch, E. P. (1983). Looking at television: Action or reaction? In J. Bryant and D. R. Anderson (Eds.), Children's understanding of television: Research on attention and comprehension. New York: Academic Press.

So I think the social answers are more critical for them.

MR. WRIGHT: I have from time to time agreed with Dan Anderson and disagreed with Dan Anderson. But I have got to say that he has absolutely captured it today and I hope that you will take that away with you. One of the most critical things, it seems to me, is to never, never, never, after this day, should anybody in this room talk about the effects of television without a modifying term. There is, indeed, no one single television. I hope we will, as I require of my students, never say "What is the effect of television" and ask "What is the effect of television that does this, or this genre, or viewed in this context, or by this kid."

I think even though we still disagree on a lot of things out here today, we perhaps converge on that. Further, I would like to point out to Jennings something in support of his analysis. There are a lot of people who are not happy with using the cut or the single camera shot as a unit of pace and they want to know something more oriented toward content like the scene length.

Others like Dan want to know the attention span length. We must do all of those. In an attempt to do that, we have asked students to go out into classrooms and record very precisely the duration of time in a normal school classroom, from second to fifth grade, that a child spends in apparently attentive contact with learning materials in little bouts. Yes, Dan, they have attentional inertia; it is there. Yes, it is indeed the logarithmic neural distribution that you have. Finally, the mean of that distribution is strikingly similar. It is almost exactly the same as the mean length of the average segment on *Sesame Street*. Think about that for a moment if you will.

DR. ANDERSON: If I could add a comment to that. There was a paper just published in the *Journal of Educational Psychology* by IMAI and Richard Anderson from the University of Illinois, in which the length of attention during reading lessons of first and second graders was measured. The length of time before a child showed a clear lapse in attention was measured. The data that they published could easily have come from a study of attention to television.

DR. HEALY: Are you implying that the habits of attention to television have transferred into the classroom or that the same attention bias exists in both domains?

DR. ANDERSON: At this point all of these things require a lot more research but if I were to supply an interpretation, the most parsimonious interpretation that I can think of is that the child is bringing the same attentional skills to both situations.

DR. HOPKINS: I have a more general question. I am Kevin Hopkins from Businessweek. This is a more general question primarily for Dr. Reeves. A safe generalization from the panel is that one of the most appointed critiques of television is it tends to be a passive activity and therefore hurts children because it does not involve their minds in an active or creative capacity.

One of the saving graces of television is that it is often used as background activity; it does not command the child's entire attention. So even though this passive demon may be over there in the corner of the room, the child can be creatively playing with toys and otherwise experimenting and undertaking creative play.

I would like to leap say 10 or 15 years in the future where every home, instead of a television, has a virtual reality system in which the participant dons the headgear and becomes part of a virtual world that he or she can control. That is an improvement over television in the extent that now the viewer is an active participant in the world and maybe can even change the world at will. So you do have that creative aspect of things that television lacks.

On the other side, virtual reality systems tend to be all-encompassing. You cannot do anything else while you are in a virtual world, and in fact like Nintendo and other video games may become addictive. If this panel is being held in its 15th session, 15 years from now, what is going to be the verdict on virtual reality systems versus television? Is it going to be a positive one or is it going to be a negative one?

DR. REEVES: Let me respond to the first part of that question first. As I read the literature on children and media I think there is a fairly unanimous agreement that there are some aspects of television viewing that are both passive and active. I think to pit one against the other is to make the nature/nurture debate all over again.

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BROADCAST STANDARDS
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TELEVISION AND THE PREPARATION OF THE MIND FOR LEARNING: CRITICAL QUESTIONS ON THE EFFECTS OF TELEVISION ON THE DEVELOPING BRAINS OF YOUNG CHILDREN

CONFERENCE PROCEEDINGS

October 2, 1992

Presented by:

U.S. Department of Health and Human Services

Administration for Children and Families

attention, memory, and emotional responses. Dr. Reeves is widely published in the fields of communication and psychology.

I think in this segment we will elaborate answers to some of the questions you had in the first segment. I do not know about the rest of you, I thought the questions were wonderfully interesting. Thank you all for those, and we look forward to more questions after these three speakers.

Television and Attention — Daniel R. Anderson

DR. ANDERSON: During the 1970's extravagant claims were made about children's attention to television and consequent effects on the development of attentional skills. Included were assertions that TV is mesmerizing of children; children's attention is passively captured by TV; TV is a plug-in drug; and that children's attention span is reduced by watching television.

These claims have continued to the present time. Even highly regarded educational TV programs such as *Sesame Street* have not been immune to these claims and charges. While in the last 20 years, that is, since the 1970's, researchers have come to know quite a lot about children's attention to TV. What we have learned has not lent support to these alarming claims.

That is not to say that we have answered all or even most questions about children's attention to television, much less television's effects on children's attentional development, far from it. In this brief talk, I will summarize a few salient points concerning what we know and what we do not know.

I will start out with what we know. The first point is that attention to TV develops over the preschool years. Children do not come into the world as full-blown TV viewers. Despite many claims in the newspapers and so on that infants watch large amounts of television, they in fact do not.

For example, children pay little attention to TV until about 2 years of age. Attention to TV dramatically increases through the preschool years, the next transparency illustrates that (see figure 1).

This is a figure taken from one of my publications, and it plots the percent of looking at television at home by viewers at various ages starting with infants. You notice at the first point, 0 to 1 year of age, there is essentially zero attention to television. Attention then dramatically increases up to about 5 years of age with only a slight increase after that. This is based on observations of children at home and adults for that matter, over 10 day periods of time. Numerous other studies have found exactly the same effects, both with children's programming and other kinds of programming.

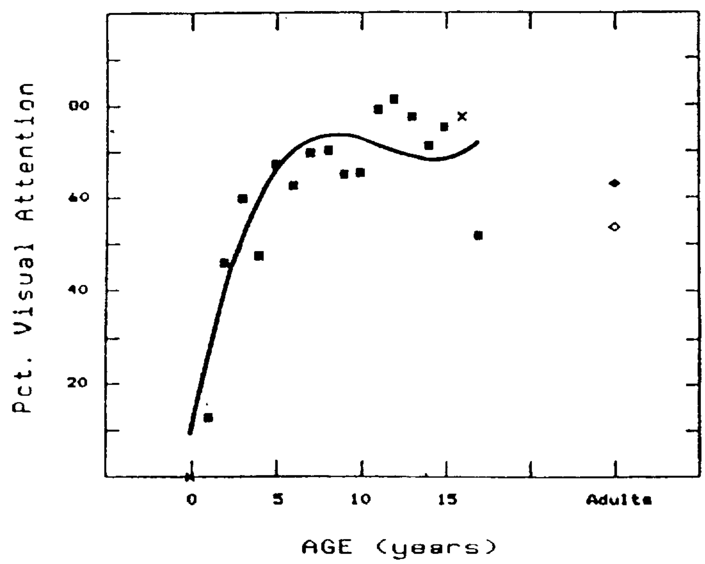

Figure 1. Indicates percent of visual attention to television as a function of age. The solid squares indicate averages in which there were three or more viewers at a given age; the x's indicate averages of one or two viewers at a given age; the solid diamond is the average for adult men; and the open diamond is the average for adult women. The line plots the best fitting polynomial for ages 0-17 years.

If television has a mesmerizing power over attention, infants and toddlers are remarkably resistant. This is relevant to these issues of claims that the children are held in place by the orienting response being repeatedly illicited by the television. I will comment on that more in a bit.

The second point is, once TV viewing is established as a regular behavior, looking at TV is nevertheless intermittent. Children frequently enter and exit the viewing area, again based on studies of what actually goes on in homes. The average time in the viewing room before leaving is less than 10 minutes. So there is a lot of traffic in homes.

This is, by the way, true of adults as well. It is not just true of children. This is totally unremarked but it is a very consistent finding. Now, when children watch television, their viewing is commonly shared with other activities such as playing with toys. During these times, children may look at and away from the TV several hundred times an hour. Again, a very common finding. This is a very different notion of the child being locked in place and mesmerized by the television.

Overall, looks at the television average about 15 seconds in length, although some looks may last as long as 10 minutes. For those who are statistically inclined in the audience, the distribution of look lengths at television is log normal, not normal. There are lots of short looks and some exceptionally very long looks.

Now, this is not to say that children are not highly attentive to the TV some of the time. Once television viewing is well established, that is, by age 2, 2½ years of age, nearly every child pays extended attention to TV on occasion. It is these periods of extended attention that I believe account for so many of the anecdotes of television mesmerizing children.

Children are active, so when you see a child paying rapt attention to something it strikes people as unusual and is considered bad by some people. Now, I have a videotape that I would like to show. There is absolutely nothing remarkable about this videotape. It is taken from our research in which we installed time lapse video cameras in people's homes. We videotaped all the TV viewing that would go on in front of the TV sets over 10 day periods.

Keep in mind that this is time lapse, so it is actually speeded up, you will be seeing two children watching television on a Saturday morning. There is a 5-year-old and her 8-year-old sister. What you will see is absolutely typical of what we have seen in over 5,000 hours of records videotaped records of children's TV viewing.

So if we could have the tape now.

(Videotape is shown simultaneously)

DR. ANDERSON: This particular TV set is in the parent's bedroom. The 5-year-old who is sitting on the left watches TV regularly on that particular TV set, so that is why we had it set up there. You are seeing a periodic insert of what is actually on the TV screen in the corner there. In a little while the *Roadrunner* cartoon comes on.

Now, the TV set is actually behind the 5-year-old, who is the one with the curly hair. So eventually you will see her turn and start to look at the television. Notice what they are doing. We see this in child after child and home after home. Television is very frequently a backdrop for other activities.

So children pay attention for periods of time, go back to their activity, go back and pay attention for periods of time and so on. Again, I emphasize every child has periods of time when they are highly attentive to the television and sit and stare for long periods on end. An exceptionally long period would be on the order of 10 minutes. A more typical long period of viewing without looking away would be on the order of about one minute.

Now, we have actually done quite a lot of research on factors that we believe are associated with attention, such as factors of television programs and of children that determine when they look up at the TV, what sustains their attention while they are looking at the television, and some factors that terminate their attention to TV and they go back to other things. I will discuss some of those now.

I guess that is all from the videotape at this point. It just continues pretty much the same way but you get the idea that television viewing is much more of a dynamic process than is popularly claimed. The next transparency illustrates the distribution of look lengths. Here we present the percent of looks at television, by 5-year-old children viewing *Sesame Street*. The data are typical of other programs as well. You can see that most of the looks at the television are very short, in this case five seconds or less with relatively fewer looks of longer duration.